WHAT ARE THE LEGAL AND POLICY IMPLICATIONS OF CONDUCTING PREEMPTION AND INTERDICTION AGAINST A WEAPONS OF MASS DESTRUCTION?

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

THE LEGAL AND FORIEGN POLICY IMPACTS OF PREEMPTION AGAINST WEAPONS OF MASS DETRUCTION, by LCDR Fred Sheehy, 68 pages.

This study examines current United States nuclear weapons policy and the legal and foreign policy aspects of preemption or interdiction against a weapon of mass destruction (nuclear), specifically when possessed by a terrorist organization in the sovereign territory of another state. The study was inspired by the concept of sovereignty, and chosen before the events of 11 September 2001.

Regardless of the effects of counterproliferation and international nuclear reactor safeguard programs, a state-sponsored terrorist-delivered nuclear weapon is only a matter of time. This study will review the technical aspects of nuclear weapons and their design, deterrence, strategy, policy, and the current legal framework that exists in the international arena.

Finally, this thesis will examine historical events of counterproliferation by preemption, and identify gaps or shortcomings, if any, in current United States policies. It concludes that a terrorist-produced weapon is an eventuality and proposes the sustainment of current policies.

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TABLE OF CONTENTS

TABLES

CHAPTER 1

INTRODUCTION

Weapons of mass destruction provide a potential adversary with an asymmetric capability to impact foreign policy, damage or destroy U.S. forces, and alter operations abroad and at home.

With the collapse of the former Union of Soviet Socialist Republics and its embedded nuclear weapons control systems, the emergence of the third world ability to procure and develop nuclear weapons and the proliferation of weapons of mass destruction and associated delivery systems have the potential to severely affect the United States.

The United States policy of deterrence against nuclear weapons worked in the bipolar world of the Cold War, but is outdated in the multipolar world of today where weapons of mass destruction can be employed not only by third world nations but by terrorist groups and transnational actors.

Primary Research Question

What are the legal and foreign policy implications of conducting preemption and interdiction against weapons of mass destruction, specifically when directed against a terrorist group located within the sovereign territory of another state?

Secondary Questions

Does the United States have the legal right to attack countries, terrorist groups, or manufacturers and stockpilers of weapons of mass destruction if there is a clear indication that they may be used against United States interests or citizens? Does the

benefit of preemption against such sites, countries, and transnational actors outweigh the possible international condemnation? Does the classic game theory "The Prisoners Dilemma" hold true for nonlanded terrorists or third world nations that do not possess the ability for a retaliatory strike? Does the United States nuclear policy need updating from its present form or is it still valid in the multipolar world? Do terrorists have the ability to produce a nuclear weapon? What is the current legal framework in place? Is the concept of anticipatory self-defense valid in this scenario?

Assumptions

There are several assumptions in this thesis that must be considered as true. The primary assumption is that nuclear weapons and weapons grade material are available to third world countries and that the technology is available for them to produce and deliver them against targets of their choosing. Second, that the United States will be faced with the use of these weapons against her in the near future. Third, that the previous United States Nuclear policy has prevented a nuclear exchange in the past.

Limitations

Limitations in this research will include the difficulty of obtaining unclassified documents from open sources on a usually highly classified topic. It will also be difficult to provide a great number of case studies where the U.S. policy of deterrence has worked due to the nature of the intelligence assets and processes associated with them. A final limitation is that while volumes have been written regarding deterrence between the U.S. and former Soviet Union, there is a lack of publications concerning nuclear strategy in the post-Cold War world.

Delimitations

This study will be at the unclassified level, relying on open sources and declassified United States government papers and resources. It will only address fissile materials used as weapons of mass destruction and will not discuss chemical or biological weapons. Finally, the events of 11 September 2001 will not be discussed.

Significance of the Study

While the attack on the USS *Cole* was not conducted by a weapon of mass destruction, it does represent an example of an asymmetric threat, a threat that I believe we are ill equipped to deal with in the near future, but will be forced to deal with in the next ten years. The temptation to use a weapon of mass destruction against the United States is assuredly growing, as we involve ourselves more in the Middle East, the Balkans, and in the Far East. I hope to make a contribution to the understanding of current United States policies and to identify the need for a change in these policies in the coming years if required.

Preview of the Study

Chapter 1, "Introduction," will introduce the thesis and the primary research question. This chapter will discuss the significance of the study, the scope of the research, and provide background for establishing the significance of the thesis. It will also address assumptions, limitations, and delimitations.

Chapter 2, "Review of Literature," will provide a brief history of the United States deterrence, a background in nuclear weapons theory and international law regarding preemption, and an evaluation and summary of published works relating to the

thesis topic. The thesis is not strongly supported by literature, since the fall of the Soviet Union, and this will be discussed in this chapter.

Chapter 3, "Research Methodology," will outline the specific research methods used to answer the primary research question as well as the secondary questions.

Chapter 4, "Analysis," will present the evidence produced from chapters 2 and 3 and provide a basis for the conclusions and recommendations.

Chapter 5, "Conclusions and Recommendations," will state the discoveries made during the research, answer the primary thesis question, and provide recommendations for further work in the field.

CHAPTER 2

LITERATURE REVIEW

As previously stated, the vast majority of scholarly literature about the thesis topic concerns strategic deterrence in the bipolar world between the United States and the former Union of Soviet Socialist Republics. While they serve to provide a strong background and offer a good discussion of the underpinnings of current United States policy, few, if any, specifically address the primary questions as laid out in chapter 1. Winnowing and sifting from these background works is required to support the thesis and to answer the primary and secondary questions. The specific pillars examined consist of deterrence, nuclear weapons, international law, game theory, and United States nuclear policy.

Deterrence

Democracy and Deterrence: The History and Future of Nuclear Strategy by Philip Bobbit begins by defining deterrence as "the ability through a nuclear threat to make an opponent refrain from what he might otherwise do" (Bobbitt 1988, 8). The author also speaks of preemption in the context of a United States-Union of Soviet Socialist Republics counter-silo nuclear exchange, in which a peer competitor has the ability to preempt the other side and its ability to respond (Bobbit 1988, 162-2). This applies directly to the thesis topic in that it is precisely what the U.S. would desire to do against a transnational actor possessing a nuclear weapon, that is, to deny his ability to respond. The great majority of the chapters in the book are dedicated to the U.S./ Union

of Soviet Socialist Republics development of strategy, and to the nuclear triad of air-delivered, land-based silos, and submarine launched missiles.

In *First Strike Stability: Deterrence After Containment* by Steven Cimbala, the author speaks directly to the concept of anticipatory preemption, in which an attack is launched based on a warning or threat of an opponent's attack, prior to the attack already having begun (Cimbala 1990, 39). He later states that the strike would be prompted, "by an international threat environment of high tension and imminent expectation of war."(Cimbala 1990, 40). It is doubtful that the U.S. would be able to predict the actual event of an attack by a non-missile-delivered nuclear weapon, and it would be equally difficult to separate out the "normal" tension in an area where terrorist groups operate, if not impossible.

Paul K. Huth in *Extended Deterrence and Prevention of Nuclear War* discusses historical events of heightened tension where nuclear exchanges could have occurred, but did not. Again, mostly dealing with the U.S.-USSR, but also the Arab-Israeli conflicts of the late 1960s and early 1970s. He additionally includes a table including the years 1885 to 1983, listing fifty-eight separate cases where extended deterrence was present, with the final outcome of successful deterrence occurring thirty-four times and a deterrence failure twenty-four times (Huth 1988, 24-27). The significance of this work to the thesis topic is the illustration that deterrence by a superior power has, in the past, failed, although never with nuclear weapons being exchanged.

Nuclear Weapons Development and Theory

The Curve of Binding Energy by John McPhee is about the development of United States nuclear weapons, safeguarding nuclear material, and building a home-made

bomb, as seen through the eyes of Dr. Theodore Taylor, a former research physicist at the Theoretical Division of the Los Alamos Scientific Laboratory. It is an excellent primer on weapons design, evolution, and the concept of plutonium recycle in the nuclear industry, and it remains the singular great work on a home-made nuclear device, even though it was written in 1973. The relation to the thesis topic is to lend credibility to the assumption that to build a weapon, it is not required to develop another Manhattan project, gaseous diffusion plant, or even a weapons program. It will be used heavily in chapters 4 and 5.

Both *The Making of the Atomic Bomb* and *Dark Sun: The Making of the Hydrogen Bomb* by Richard Rhodes serve as excellent background works on the nuclear weapon and hydrogen weapon development projects in both the United States and the former Soviet Union. Rhodes provides an exhaustive chronology of the science of bomb making from the discovery of the atom to the development of the hydrogen weapon from the viewpoint of the scientists.

Saddam's Bombmaker by Khidhir Hamza and Jeff Stein. Hamza was the chief Iraqi nuclear weapons scientist for Saddam Hussein from 1971 until his defection in 1994. Hamza outlines the Iraqi nuclear and chemical-biological weapons programs evolution and development, but most of the book concerns his family and their escape from Iraq. He does state in the epilogue that the Iraqi's had developed a “device capable of producing a nuclear explosion equivalent to a few kilotons of TNT” but were unable to test it to determine a true yield (Hamza and Stein 2000, 334). He also states that Iraq was pursuing a plutonium implosion weapon, not the easier to produce gun-type uranium

style weapon. Finally, he discusses the Israeli attack on the Osiraq nuclear reactor in 1981 and the effects it had on the development of the weapons program.

There are numerous papers and presentations lending credibility to the home-made bomb theory, which will be further discussed in chapter 4. Among these are "Reactor-Grade Plutonium's Explosive Properties" by J Carson Mark, written for the Nuclear Control Institute, discusses in detail the fallacy that weapons grade plutonium or highly enriched uranium (HEU) are the only suitable materials for bomb making. "Can Terrorists Build Nuclear Weapons?" by Carson Mark, Ted Taylor, Eugene Eyster, William Maraman, and Jacob Weschler, also written for the Nuclear Control Institute outlines materials, possible size, yields, and different designs, both "crude" and "more sophisticated" (Mark, Taylor 1993, 1). "The Nuclear Terrorist Threat" by Kevin O'Neill, written for the Institute for Science and International Security (ISIS), discusses the Mark and Taylor work cited above and discusses widely available resources on the internet, amounts of plutonium, and highly enriched uranium in the spent nuclear fuel stockpiles and reprocessing facilities worldwide. O'Neill also discusses several materials that could be used to make a weapon and includes their "bare critical sphere" weights, that amount of fissile material required to produce an explosion without an added reflector (O'Neil 1997, 4). Finally, "Secrecy and Misguided Policy" by A. David Rossin, was written for the Center for International Security and Cooperation. He discusses the requirement for secrecy surrounding the Manhattan project and the lingering requirement for secrecy regarding nuclear weapons design. The application to the thesis topic is that he discusses the explosion of a United States nuclear weapon in 1962 where the fissile material was not plutonium or HEU, but "high burnup plutonium," plutonium that had come from a

power producing reactor and not been specifically enriched for use in a weapon (Rossin 2001, 3).

International Law

According to *The Law of Land Warfare*, FM 27, nuclear weapons are not specifically illegal to use, although "It is specifically forbidden *** to employ arms, projectiles, or material calculated to cause unnecessary suffering" (1956, 18). The International Court of Justice handed down an advisory opinion in 1996, stating that there was no law or convention preventing the threat or use of nuclear weapons, although it would be "generally contrary to the rules of international law applicable in armed conflict, and in particular the principles and rules of humanitarian law"(The Law of Land Warfare 1956, a-e).

The Operational Law Handbook provides a good discussion on the use of force and international law. It discusses Article 51 of the United Nations Charter, which defines the role of self-defense. The handbook also discuses the concept of "Anticipatory Self-Defense" and how the United Nations charter does not adequately address it and remains a controversial topic. Finally, it discusses the role of Anticipatory Self-Defense in the CJCS Standing rules of engagement.

"'Anticipatory' Self-Defense Against Terrorism Is Legal" by Lee A. Casey and David B. Rivkin Jr is a legal opinion letter written for the Washington Legal Foundation. It discusses the origins of anticipatory self-defense in the United States in the *Caroline* case in 1837, in which British troops crossed the Niagra River into the future new York and seized and destroyed a steamship to prevent its use in a insurrection. The United States, with little argument, accepted the concept (Casey and Rivkin 2001, 2). It further

discusses the Israeli strike against the Iraqi OSIRAK nuclear reactor complex, noting that although the United Nations Security Council condemned the act, no sanctions were ever issued against Israel. It further cites the United States actions in Grenada, and in the 1986 raids in Libya in Operation Eldorado Canyon, and the Kennedy administration's blockade of Cuba during the Cuban missile crisis in 1962.

Game Theory

Behavior Society and International Conflict, Volume III, Philip E. Tetlock, editor, is a behavioral science view of War, violence, and conflict. It provides two applicable game theories, the "Prisoner's Dilemma" and the "Colonel Blotto Game." The "Prisoner's Dilemma" traditionally deals with two prisoners who have been arrested and with their choices to confess or to remain silent. Their sentence depends not only on their answer, but that of the other prisoner. It is not a zero-sum game, there are outcomes that can be a tie. This was applied to the U.S.-Union of Soviet Socialist Republics bipolar nuclear world, where "not confessing" was the equivalent shooting first, and "confessing" or not shooting earned a "larger sentence." The payoff was to shoot first (Tetlock 1993, 214). The "Colonel Blotto Game" concerns a mythical commander who has two forts to defend, with two divisions. His opponent has two divisions to attack with, but the defender does not know where he will be attacked. If he defends each fort with one division, there is no payoff. If he defends a single fort with two divisions, and guesses correctly, he receives the highest payoff. The specific applicability to the thesis question regards the "payoff" of striking a target first, vice retaliating against a strike. This will be further developed in chapter 4.

United States Nuclear Weapons Policy

In *Mimicking Sisyphus: America's Countervailing Nuclear Strategy* Louis Beres discusses the nuclear stalemate between the U.S.- Union of Soviet Socialist Republics and possible alternatives to mutually assured destruction. These alternatives include a comprehensive test ban, to prevent the development of new nuclear weapons, the suggestion of a "no-first-use pledge" which the former Soviet Union made in 1982; and Beres suggests that the United States make the same pledge, which it has not to this date (Beres 1983, 102). He also suggests a "Joint Nuclear Freeze," in which both sides renounce the testing, deployment, and production of nuclear weapons and those platforms designed to specifically deliver nuclear weapons (Beres 1983, 109). The applicability to the thesis is that of a non- mutually assured destruction scenario between the United States and a potential attacker.

Robert Jervis in *The Illogic of American Nuclear Strategy* discusses the United States policy of "countervailing strategy," in which he discusses the evolution of policy from counterforce to countervalue, and from "no cities" to mutually assured destruction (Jervis 1984, 65). He additionally argues that the U.S. strategy should be a stance that "minimizes the gap between what it threatens in peacetime and what it would do in a war" (Jervis 1984, 67).

The Future of U.S. Nuclear Weapons Policy by the Committee on International Security and Arms Control, National Academy of Sciences, directly addresses United States nuclear policy after the Cold War and the breakup of the former Soviet Union, and further discusses the Nuclear Posture Review (NPR) of 1994. Specifically, the lesser likelihood of all-out nuclear war between the U.S. and the former Soviet Union, the

growing importance of regional conflicts, and the proliferation of nuclear knowledge and materials.

Presidential Decision Directive (PDD) 39, U.S. Policy on Counterterrorism, and Presidential Decision Directive 62, Combatting Terrorism. PDD 39 defines the United States policy on counterterrorism as "deter, defeat, and respond" to all attacks on us citizens, property, and territory, at home or abroad (U.S. President 1995, 1) PDD 62 reaffirms and references PDD 39, and "provides a more systematic approach" to combating terrorism and establishes the office of the national Coordinator for Security, Infrastructure Protection, and Counter-Terrorsim (U.S. President 1998, 1). Both these directives are classified, and only redated excerpts are available.

The single work closest to the thesis topic is entitled "Radical responses to Radical Regimes: Evaluating Preemptive Counter-Proliferation," written by Barry Schnieder for the Institute for National Strategic Studies at the National Defense University in 1995. Schnieder discusses the addition of the Counter-Proliferation Initiative to the United States Department of Defense missions to prevent the spread of weapons of mass destruction and provides a blueprint of elements that the United States should consider prior to conducting preemption against a weapon of mass destruction. He also warns that a preemptive strike must be totally successful, or "it could spell disaster for the U.S." (Schnieder 1995, vi). Schnieder provides a historical reference since World War II in which counterproliferation by preemption (PCP) has worked for the attacker, from the destruction of the Nazi atomic program to the two attacks on Iraq's Osirak reactor complex, first by the Iranians and finally by the Israelis. He concludes

with "Scud" hunting during Operation Desert Storm in 1991 (Schnieder 1995, 8-9). He also discusses the Cuban Missile Crisis where PCP was not used.

Definitions

Anticipatory Self-Defense. The concept in which a state may use preemptive or preventative force not only to repel an attack but to defend against "imminent" armed attacks (Casey and Rivkin 2001, 1).

Fissile Material. Material capable of undergoing nuclear fission (Oxford 1993, 327).

Interdiction. Authoritative prohibition. To prohibit and action (Oxford 1993, 462).

Plutonium. A radioactive metallic element (Oxford 1993, 686).

Plutonium recycle. The chemical process by which a nuclear reactor, specifically a breeder reactor, converts uranium to plutonium resulting in a higher percentage of plutonium in the reactor core at the end of expected core life than at the beginning (McPhee 1973, 46-9).

Preassembly. The inadvertent introduction of a critical configuration of the fissile material at some stage (Mark and Taylor 1993, 5). Also known as a "fizzle yield."

Preemption. Intended to prevent attack by disabling the enemy

Sovereignty. A self-governing state.

Transnational Actor. An individual, group, or organization operating outside the framework of traditional countries or nation-states desiring recognition, sovereignty, or a political aim.

Uranium. A radioactive grey dense metallic element, capable of nuclear fission and used as a source of nuclear energy (Oxford 1993, 1013).

Weapons of Mass Destruction. Devices designed with nuclear material intended to cause damage by a supercritical chain reaction. (Does not include weapons of mass effect (WME) or such devices designed to contaminate an area through the spreading of radioactive material).

CHAPTER 3

RESEARCH METHODOLOGY

This thesis will examine the legal and foreign policy implications of preempting the use of a nuclear weapon possessed by a terrorist group in the sovereign territory of another state. Additionally, United States nuclear and foreign policies will be examined , and an attempt will be made to identify any gaps that may exist, and ultimately, recommend changes to these programs and policies. It will also examine the legal framework of nuclear, and the possibility of a terrorist-produced nuclear device.

As stated previously, other than a few key works, the bulk of the literature concerns specifically the United States and the former Soviet Union, and scholarly work regarding the thesis question is limited. To offset this, a series of documents were studied (chapter 2) and pertinent portions applied to the topic. The purpose of this was to blend the appropriate issues and elements of the literature concerning deterrence, preemption, and nuclear weapon production.

The United States policy and strategy regarding nuclear weapons and foreign policy will be examined. The second step in the research methodology is to examine United States nuclear policies concerning terrorists and terrorism, legal precedent concerning preemption and the production of nuclear weapons, and determine if they are current or require updating to better address the post-Cold War environment. The thesis will also examine the possibility of terrorist organizations' ability to produce a home-made nuclear device capable of explosion.

Nuclear deterrence is specifically examined, and an argument can be made that since the United States was not attacked by the former Soviet Union, deterrence was and

is a successful policy. This thesis will examine whether it is still a valid policy for the United States, especially after the issuance of Presidential Decision Directives 39 and 62, two of the very few documents to address a nuclear attack, or the threat of a nuclear attack, from a rogue nation.

After an examination of nuclear strategy and policies, a critical assessment will determine shortfalls, if any, and provide suggestions and recommendations for what United States policy should be. The end result of the methodology, and the entire thesis, is an updated nuclear policy or an affirmation of the current policies and a better understanding of terrorist nuclear capabilities.

CHAPTER 4

ANALYSIS

Legal Implications

Conducting preemption on a weapon of mass destruction possessed by a terrorist organization could occur in several forms: a strike by aircraft as seen in the Israeli raid on the Osirak nuclear compound in Iraq in 1980, an assault with cruise missiles as witnessed in the United States strike against the Zaafaraniyah nuclear site in Iraq in 1993, the sinking of a ship at sea, or a special forces action on the ground. Whatever the method of preemption, United States forces would undoubtedly be required to violate the sovereign territory of some country in order to carry out their assigned mission. While the degree on violation could range from simple over flight of cruise missiles to aircraft ingress and egress, to actual forces on the ground, it remains a violation of international law to conduct hostilities against an opponent without warning.

> The contracting Powers recognize that hostilities between themselves must not commence without previous and explicit warning, in the form either of a reasoned declaration of war or of an ultimatum with conditional declaration of war. (U.S. Army 1956, 15)

However unlikely it is that the United States would warn a possessor of a weapon of mass destruction that it were about to attack, the United Nations has made provisions for self-defense. The United Nations Charter also dictates that members "refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any state" (UN 1945, Article 2). Clearly, the United States would risk international condemnation if it conducted a strike against a weapon of mass destruction on foreign soil or in international waters. The United Nations does make an

exception in the case of self-defense. Article 51 of the Charter of the United Nations states,

> Nothing in the present Charter shall impare the inherent right of individual or collective self defense if an armed attack occurs against a Member of the United Nations, until the Security Council has taken measures necessary to maintain inter-national peace and security. Measures taken by members in the exercise of this right of self defence shall be immediately reported to the Security Council and shall not in any way affect the authority and responsibility of the Security Council under the present Charter to take at any time such action as it deems necessary in order to maintain or restore international peace and security. (UN 1945, Article 51)

It is unlikely that a terrorist organization will ever be allowed to join the United Nations. Possessing no land or international recognition, they would have no standing. The laws are clear in the case of United Nations members attacking United Nations members. But Article 51 deals solely with self-defense after an "armed attack." There is no cause for preemption of a weapon of mass destruction if the attack has already occurred.

Anticipatory self-defense was previously defined in chapter 2 as, "the concept in which a state may use preemptive or preventative force not only to repel an attack but to defend against "imminent" armed attacks" (Casey and Rivkin 2001, 1). It remains in the international community a disputed topic. One of the oldest references to the principle of anticipatory self-defense comes from Rene Beres quoting Hugo Grotius:

> Now, as Cicero explains, this justification for anticipatory self-defense exists whenever he who chooses to wait for formal declarations will be obliged to pay an unjust penalty before he can exact a just penalty; and, in a general sense, it exists whenever matters do not admit delay. Thus it is obvious that a just war can be waged in return, without recourse to a judicial procedure, against an opponent who has begun an unjust war; nor will any declaration of that just war be required. . . . For, as Aelian says, citing Plato as his authority, any war undertaken for the necessary repulsion of injury, is proclaimed not by a crier nor by a herald but by the voice of Nature herself. (Beres and Tsiddon-Chatto 1997, 2)

Beres continues, quoting Pufendorf in *On The Duty of Man and Citizen* According to:

Natural Law

> Where it is quite clear that the other is already planning an attack upon me, even though he has not yet fully revealed his intentions, it will be permitted at oce to begin forcible self-defense, and to anticipate him who is preparing mischief, provided there be no hope that, when admonished in a friendly spirit, he may put off his hostile temper, or if such admonition be likely to injure our cause. Hence, he is to be regarded the aggressor, who first conceived the wish to injure, and prepared himself to carry it out. But the excuse of self defense will be his, who by quickness shall overpower his slower assailant. And for defense, it is not required to one receive the first blow, or merely avoid and parry those aimed at him. (Beres and Tsiddon-Chatto 1997, 3)

The premier modern case involving anticipatory self-defense was the 1837 case of the vessel *Caroline*, a United States flagged steamship on the Niagra River, in what is now today New York state. Claiming self-defense, British forces crossed over the river into (sovereign) U.S. territory, "rousted" the crew, killing one passenger, and setting the *Caroline* adrift in the river (Canadian Historical Review 1990, 1). The United States accepted the principle of self-defense in the case, but then Secretary of State Daniel Webster noted that, "The necessity of that self defense [must be] instant, overwhelming, and leaving no choices for means and no moment for deliberation" (Casey and Rivkin, 2001, 2). In the years between 1837 and the present, the United States and other countries have broadened the rigid definition as cited from Secretary Webster. Historical precedents from other countries include: Israeli strikes against Egypt in 1956, and again in 1967 during the Six Day War, the British declaration of a 150-nautical-mile exclusion zone around the Falkland Islands (Malvinas) in 1982, and finally the Swedish declaration of "armed force" against any submarine located within 12 nautical miles of its territorial sea in 1983 (Casey and Rivkin 2001, 2).

The dispute regarding anticipatory self-defense is that of "anticipatory" versus "preemptive" self-defense, where an attack is made against an enemy or future enemy sooner than later. The primary question that must be answered is the intent of the enemy: if he will attack and when (Beres and Tsiddon-Chatto 1997, 2). The central argument is that each side has a version of the facts.

The United States has also exercised anticipatory self-defense in the past. President John Kennedy in 1962 justified the naval blockade of Cuba in self-defense, with no shots being fired by either side. This is the first peacetime example of preemptive counterproliferation against a nuclear weapon or facility. President Ronald Reagan asserted anticipatory self-defense twice, first in the invasion of Grenada in 1983, to safeguard human life, and in the 1986 airstrikes against Libya in Operation Eldorado Canyon (Casey and Rivkin 2001, 2). It could also be argued that the 1994 cruise missile attacks against the Zaafaraniyah nuclear complex in Iraq was anticipatory self-defense, though the United States cited support of United Nations Security Council Resolutions 687, 707, and 715 as justification (Federation of American Scientists 2000a, 1). This also serves as the second peacetime example of United States preemptive counterproliferation.

Another country that has a long history with anticipatory self-defense is Israel. As previously cited, Israel cited self-defense in the 1956 and 1967 strikes against Egyptian and Arab forces. The most famous case of preemptive counterproliferation are the 1981 Israeli air strikes on the Iraqi nuclear reactor Osiraq, known as Osiraq II, to differentiate from Osiraq I, the Iranian raid on the same complex in 1980 during the Iran-Iraq war (Schnieder 1995, 8). The Iraqi's had purchased a French nuclear reactor which

Israel maintains was designed to "produce militarily significant amounts" of plutonium in order to produce a nuclear weapon (Beres and Tsiddon-Chatto 1997, 1).

As illustrated above, the two key proponents of anticipatory self-defense in the modern era have been the United States and Israel, and another key question is, "When is a threat a threat?" (California Polytechnic Institute 2002, 3). Obviously it would be undesirable to have rival countries justifying offensive military action as anticipatory self-defense. The United Nations Charter, Article 2(4) states that "the use of force is forbidden only in instances where it threatens the territorial integrity or political independence of a state" (Casey and Rivkin 2001, 2). While this is not a license to undertake violence and aggression as long as it does not violate the above, it is in conflict with United Nations Article 51. It has been argued by both the United States and Israel that the concept of anticipatory self-defense is not in compliance with Article 51 and "counterproductive to the goal of peaceful resolution" of international disputes.

> In contrast, the majority of States, including the U.S., argue than an expansive interpretation of the Charter is more appropriate, contending that the customary law right of self defense (including anticipatory self defense) is an inherent right of a sovereign state that was not "negotiated" away under the Charter. Arguing that contemporary experience has demonstrated the inability of the Security Council to deal effectively with acts and threats of aggression, these States argue that rather than artificially limiting a State's right of self defense, it is better to conform to historically accepted criteria for the lawful use of force, including circumstances which exist outside the "four corners" of the Charter. (U.S. Army Operational Law Handbook 2000, 3)

The Israeli argument is similar to that of the United States, but the definition differs. In the case of Osiraq I specifically and "Arab Aggression" in general, Israel defines anticipatory self-defense as, "entitled to strike first when the danger posed in 'instant, overwhelming, leaving no choice of means and no moment for deliberation'"

(Beres and Tsiddon-Chatto 1997, 1). A further argument asserted by Israel is that a past declaration by Iraq that a state of war exists between Iraq and "the Zionist entity," Israel was justified in its preemptive attack (Beres and Tsiddon-Chatto 1997, 1).

While the specific outcomes of particular incidents of anticipatory self-defense and counterproliferation by preemption will be discussed later, the critics of Israel's interpretation of anticipatory self-defense include the United Nations. In response to the 1980 Israeli attack on the OSIRAQ reactor, on 19 June 1981, the United Nations Security Council Issued Resolution 487 (1981) which said in part:

> Considering that, under the terms of Article 2, paragraph4, of the Charter of the United Nations, "all members shall refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any State, or in any other manner inconsistent with the purposes of the United Nations." (United Nations 1981, 1)

United Nations Resolution 487 further states that the United Nations:

> Fully Recognizes the inalienable sovereign right of Iraq and all other States, especially the developing countries, to establish programmes of technological and nuclear development to develop their economy and industry for peaceful purposes in accordance with their present and future needs and consistent with the internationally accepted objectives of preventing nuclear-weapons proliferation. (United Nations 1981, 1).

In a review of *Self-Defense in International Law: The Israeli Raid on the Iraqi Nuclear Reactor* written by Timothy McCormack in 1996 and reviewed by David Kowalski in the "Law and Politics Book Review" in 1998, Kowalski argues that attack was not legal in regard to timing out that the attack did not meet the internationally accepted definition of anticipatory self-defense, that the "necessity of that self defense [must be] instant, overwhelming, and leaving no choice of means, an no moment for deliberation" (Casey and Rivkin 2001, 2). In fact, the raid occurred before the reactor

was operational or able to produce any quantity of plutonium (Federation of American Scientists 2000a, 1). Adding credence to the unanimous adoption of United Nations Resolution 487 was the fact that not only had Iraq fully complied with all International Atomic Energy Agency (IAEA) guidelines regarding safeguards, but was also a member of the Non-Proliferation Treaty and additionally confirmed that the reactor had not yet gone critical. The International Atomic Energy Agency went even further noting that Israel was not a signatory of the Non-Proliferation Treaty and had refused inspection of its own nuclear facility located at Dimona (Federation of American Scientists 2000a, 1)

Foreign Policy and Preemption

Historical precedents for preemption of nuclear weapons, programs, production, and arms begin in 1941 with the attacks on the German nuclear laboratories and facilities in Germany, France, and Norway, and end with the United States 1998 cruise missile attacks against the Taji repair facility in Iraq during Operation Desert Fox. Table 1 gives a breakdown of the incidents.

In the first two examples, the Norsk-Hydro special forces action and the eventual air strikes by Allied bombers and the destruction of the Tokyo cyclotron, the nations were at war, and these facilities were legitimate military targets, both occurring during the Second World War, against a more developed program in Germany and a more rudimentary one in the case of Japan (Schnieder 1995, 9-12). In the first case, the attacks failed to physically destroy the objective, but did cause the entire operation to be moved to Germany, where it was eventually destroyed by Allied Strategic Bombing (Schnieder 1995, 10).

Table 1. Historical Examples of Preemption Against Weapons of Mass Destruction

Year	Target	Location	Method	Results
1941-3	Norsk-Hydro	Norway	SOF/Airstrike	Program moved to Germany
1945	Cyclotron	Tokyo	Airstrike	Destroyed
1962	Cuba	Missile site	Naval Blockade	Missiles removed
1980	Osirak I	Iraq	Airstrike	Damaged
1981	Osirak II	Iraq	Airstrike	Destroyed
1984-8	Busher	Iran	Airstrikes	Damaged and Eventually destroyed
1991	Osirak	Iraq	Airstrike	Damaged
1993	Zaafaraniyah	Iraq	Cruise Missiles	Damaged
1998	Taji	Iraq	Cruise Missiles	Destroyed

(Table complied from "Radical Responses to Radical Regimes: Evaluating preemptive Counter-Proliferation" by Barry R. Schnieder, Institute for National Strategic Studies, Washington DC, 1995, and from data from the Federation of Atomic Sciences nuclear guide to Iraq)

The Cuban Missile Crisis and the eventual U.S. naval blockade of the island of Cuba stands out as unique in that neither country was at war with the other (the U.S. and Cuba by proxy). In the end no air strikes were launched, and the preemption was considered successful as the Soviet Union removed its missiles from Cuba. It is noteworthy that while the UN had been formed, the Security Council did not produce sanctions against the United States, which however had acted on a unanimous vote from the Organization of the American States (OAS) to take action (Preble 2002).

In the first Osirak raid (Osirak I) in 1980 flown by Iran, both countries were at war, and while the reactor complex was damaged, it was not destroyed. The attack consisted of just two Iranian F-4 Phantom jets in company with a larger strike force attacking a different target nearby. For the rest of the eight-year war between the two countries, Iran never again attacked the Osirak complex, and the reactor was operational

a short time later. It remains unclear whether the reactor was an intended target or a target of opportunity for the Iranians (Schnieder 1995, 13).

The 1981 Israeli raid on Iraq's Osirak nuclear complex (Osirak II) represents the first counterproliferation by preemption against a nuclear weapon or capability not during a war and involving actual combat. Estimates indicate that Iraq was "between one to two" or "five to ten" years from building a bomb depending on the source (Schnieder 1995, 14), or that the reactor had not yet become operational (Federation of American Scientists 2000a, 1). Osirak II also represents the first action from the United Nations, in Security Council Resolution 487 as previously discussed, in response to a preemption using force against a weapon of mass destruction.

In the Iraqi raids against the Iranian reactor in Bushehr from 1984 to 1988, totaling seven separate actions conducted by air strikes, reduced the Iranian ability to produce and significant amount of weapons grade material (Schnieder 1995, 15).

During Operation Desert Storm in 1991, the Osirak complex was struck no less than eleven separate times by United States Air Force F-15s, F-117s, and F-111s, using guided and unguided munitions. The Defense Intelligence Agency concluded that the Iraqi facility was "severely degraded" in its ability to conduct research or to process fuel (Federation of American Scientists 2000a, 2) after these strikes.

The 1993 Zaafaraniyah Tomahawk Land Attack Missile (TLAM) strike against the Iraqi nuclear fabrication facility utilized forty-four separate missiles launched from four different United States Navy ships. The strike was conducted in support of United Nations Security Council Resolutions 687, 707, and 715, stemming from Iraq's refusal to allow United Nations weapons inspectors access to its programs of mass destruction

weapons. Weapons inspectors who later visited the site confirm that special machinery used in the production of nuclear weapons had been destroyed. The 1998 Operation Desert Fox strikes against Taji and again at Zaafaraniyah destroyed more special machinery and a tool plant (Federation of American Scientists 2000a, 2,3).

Of the nine incidents as described in table 1, eight were attacked from the air, two of those being purely cruise missile attacks and one involving special forces (Norsk-Hydro). Of the eight targets attacked from the air, three were destroyed coincidently during a strategic bombing campaign (Germany, Japan, Osirak 1991), four were damaged and not initially destroyed, and one was destroyed (Osirak II). The ninth incident involved the United States naval blockade of the country of Cuba, with no shots being exchanged.

Of the two attacks against a nuclear capability that were successful and resulted in the immediate destruction of the target (Osirak II and Taji (Desert Fox)), one was in support of the United Nations Security Council resolutions, and one was eventually sanctioned by the Security Council.

Game Theory

In the classic game theory illustration of the Prisoner's Dilemma, two men commit a crime and are arrested. They are held in separate cells and interrogated. If both confess to the crime, each will receive fifteen years. If neither confesses, the police will issue a partial sentence of one year. If one confesses and the other does not, the confessor will immediately go free and the other will receive the maximum punishment of twenty years.

An important point to remember about the scenario is the goal is to get a lighter sentence for both parties. If both parties remain silent, both receive one year. If both

confess, they receive fifteen years. If "cooperating" is substituted for "remaining silent" and "defecting" replaces "confessing," the scenario looks like this (table 2), with the payoffs listed:

Table 2. The Prisoners Dilemma

A defects: 10 years B defects: 10 years	A cooperates: 20 years B defects: 0 years
A defects: 0 years B cooperates: 20 years	A cooperates: 1 year B cooperates: 1 year

For both to receive the least sentence as a group, both must cooperate with each other. But this is not the highest payoff. The highest payoff (or lowest amount of time served) is zero, when one player defects and the other cooperates. Both can win (cooperation), both can lose (defection), but each can cause the other to serve more time (Tetlock 1993, 214). During the Cold War, this was applied to the United States and the Soviet Union regarding nuclear deterrence. If both sides cooperated (deterrence works, neither side shoots the other) the outcome was not total hegemony (zero), but a very reasonable one. If each side defected (launched their nuclear weapons), the result was equal destruction for both (ten years for each). The highest payoff, however, is reserved for defecting while the opponent cooperates (no sentence versus twenty years), the destruction of his military and the complete security of yours. Chapter 5 will examine if this scenario is still valid for the United States when dealing with terrorist organizations possessing nuclear weapons.

United States Nuclear Weapons Policy

Nuclear weapons policy in the United States has evolved to meet the changing political and strategic environments in the world as first the Soviet Union developed nuclear weapons and then became a peer competitor. As other nations acquired nuclear weapons, the policy was adjusted, but still focused on the Soviet Union as the most likely opponent in a nuclear exchange. As the policy shifted from mutually assured destruction to the "countervailing" strategy that of exchanging blow for nuclear blow, the weapons systems and amounts were both improved and increased (Beres 1983, 1). The "assured" portion of weapons of mass destruction came from the Strategic Triad of fixed missile silos on land, aircraft capable of delivering nuclear weapons, and strategic missile submarines. While it could be argued that weapons of mass destruction and the countervailing strategy worked for years and prevented a nuclear war, "and proof of cause and effect is always elusive in international affairs, as is, even more generally, proof of why something did *not* happen" (Committee on International Security and Arms Control 1997, 1).

The latest United States Nuclear Weapons policy is the Nuclear Posture Review (NPR) submitted to Congress on 31 December 2001. While the majority remains classified, unclassified excerpts are available from the Organization for Global Security. The Nuclear Posture Review identifies a "New Triad" consisting of:

> Offensive Strike Systems (both nuclear and non-nuclear); defenses (both active and passive); and a revitalized defense infrastructure that will provide new capabilities in a timely fashion to meet emerging threats. The New Triad is bound together by enhanced command and control (C2) and intelligence systems. The establishment of this New Triad can both reduce our dependence on nuclear weapons and improve our ability to deter attack in the face of proliferating WMD [weapons of mass destruction] capabilities in two ways: [First] The addition of

> defenses (along with the prospects for timely adjustments to force capabilities and enhanced C2 and intelligence systems) means that the U.S. will no longer be as heavily dependant on offensive strike forces to enforce deterrence as it was during the Cold War. [Second] The addition of non-nuclear strike forces--including conventional strike and information operations--means that the U.S. will be less dependent than it has been in the past on nuclear forces to provide its offensive deterrent capability. (Organization for Global Security 2002, 1)

While not actually a policy it is a "direction" for nuclear forces and force structure to follow and be tailored to. It would appear to include "Assure, Dissuade, Deter, and Defeat" as its main tenets and that it does address the end of the Cold War and at least partially the possibility of a rogue nation or actor possessing a nuclear device, but the actual document is still classified and will require further study when downgraded, declassified, or released (Organization for Global Security 2002, 4).

Other United States policies addressing nuclear weapons and terrorism are Presidential Decision Directive 39 and Presidential Decision Directive 62. Presidential Decision Directive 36 has been redacted and declassified, while Presidential Decision Directive 62 remains classified, but a White House press release refers to it in detail, as does an unclassified abstract from the Office for Domestic Preparedness Support (U.S. President 1998, 1)

Presidential Decision Directive 39,U.S. Policy on Terrorism, was released in June 1995 (PDD 39, 1). The opening paragraph states,

> It is the policy of the United States to deter, defeat, and respond vigorously to all terrorist acts on our territory and against our citizens, or facilities, whether they occur domestically, in international waters or airspace or on foreign territory. The United States regards all such terrorism as a potential threat to national security as well as a criminal act and will apply all appropriate means to combat it. In doing so, the U.S. shall pursuer vigorously efforts to deter and *preempt*, apprehend and prosecute, or assist other governments to prosecute, individuals who perpetrate or plan to perpetrate such attacks(U). (U.S. President 1995, 1)

It further specifically addresses deterring terrorism "through a clear public position that our policies will not be affected by terrorist acts and that we will act vigorously to deal with terrorists and their sponsors. Our actions will reduce the capabilities and support available to terrorists." It specifically addresses the question of weapons of mass destruction by stating that: "There is no higher priority than preventing the acquisition of this capability [weapons of mass destruction] or removing this capability from terrorist groups potentially opposed to the U.S." (U.S. President 1995, 2, 9).

Presidential Decision Directive 62, Protection Against Unconventional Threats to the Homeland and Americans Overseas was released in May of 1998 It states that terrorist groups have "the knowledge, skills, and abilities to use WMD" and that the United States needs to improve its domestic preparedness for such an event (U.S. President 1998, 1). Presidential Decision Directive 62 also established the Office of the National Coordinator for Security, Infrastructure Protection and Counter-Terrorism and reaffirms Presidential Decision Directive 39 (U.S. President 1998, 1).

In 1993, then Secretary of Defense Les Aspin announced the creation of a new program, called the Defense Counter Proliferation Initiative (CPI), to combat the spread of weapons of mass destruction (Schnieder 1995, v). Included in the CPI are:

> Additional preparations for combating nuclear, biological, chemical (NBC) and missile weapons on future battlefields, by changes in contingency planning, doctrine, equipment, and training;
> Stepped-up monitoring of selected NBC/missile programs around the world, and a tighter coordination of U.S. defense and intelligence operations directed against emerging programs and arsenals;
> Improved non-nuclear weapons capable of penetrating and destroying underground facilities;
> A U.S. diplomatic offensive aimed at NATO, Japan, and other allies to persuade them to take similar steps to strengthen their own counter-proliferation efforts;

> Accelerating funding for high-technology defense programs to facilitate the timely detection and location of mobile missile systems like Iraqi SCUDS;
> Enlisting Japan in a cooperative effort to develop a regional ballistic missile defense program against a potential North Korean nuclear missile threat;
> Renewed emphasis on developing effective theatre missile defense capable of intercepting missiles with NBC warheads;
> Altering the 1972 ABM Treaty to permit the development, testing, and deployment of an effective U.S. theatre defense system;
> Setting up an interservice office for dealing with defenses against biological weapons. (Schnieder 1995, 1-2)

Terrorist Designed Nuclear Weapons

The case for a home-made bomb

The debate on an indigenously produced nuclear device has gone on literally since the end of the Second World War. In later years it was argued that terrorists or other non-nuclear states "would need another MANHATTAN Project" to produce a nuclear device (McPhee 1973, 123-4, 136). Scientists who worked on the Manhattan Project maintain that terrorists would not require another Manhattan to accomplish their goal, most notable Dr. J. Carson Mark, former head of the Theoretical Division of the Los Alamos National Laboratory, and a former member of the U.S. Nuclear Regulatory Commission Advisory Committee on Reactor Safeguards, and Dr. Theodore B. Taylor, a colleague of Mark, who also worked at the Theoretical Division at Los Alamos, and deigned the UNITED STATES's smallest and most powerful fission weapons. What Manhattan had was an incredible amount of arguably world-class academic talent, the resources of the United States industrial base on a wartime footing and a sense of urgency to beat the Germans in a race to completion. What they needed to discover was:

> They needed nuclear and neutronic data--energy estimates and so forth. They needed equation of state datato estimate assemblies or explosions. They needed to know the probability of initiating a neutron chain [reaction]. They needed a way to estimate the dependence of efficiency on various parameters-such as the

> mass of material, energy generation, and features of dissambly, or it would be impossible to decide if, say, five critical masses were needed for an effective bomb, or one and one-tenth, whatever. They needed to develop numerical techniques for making neutron multiplications. They needed hydrodynamic calculations. They needed computing equipment. And finally, they needed people who could ask the right questions and suggest the significance of the answers when they found them. . . . You now *have* items one thru seven. You don't need to ask the questions. . . . They're all measured and published. Everything is unclassified except [the numbers for] plutonium. So far as we know, everybody in the world who has tried to make a nuclear explosion since 1945 has suceeded on the first try. (McPhee 1973, 137-8)

What terrorists, or other emerging countries would require would be a "few knowledgeable people," and a quantity of fissile material (Mark and Taylor , 1993, 4).

Taylor argues that "the math has already been done" and notes that the Los Alamos Primer, written by the scientists in 1943 as they were building the first bombs, is available for purchase and could be understood "by anyone who had got a fairly good grade in an introductory course in reactor engineering, or reactor theory, even at the undergraduate level"(McPhee, 1973, 194). Another bias that exists is the thought that a terrorist would have to build the sort of weapons that the United States and other nuclear powers have built in the past. Specifically, small, powerful, air deliverable by missile or aircraft, virtually guaranteed to go off. This bias has clouded the real issue. The first two weapons produced at Los Alamos, the implosion-type "Fat Man" and the gun barrel-type "Little Boy" were designed conservatively, to have a high probability of success, so as not to fall into Japanese hands if they failed to detonate (McPhee 1973, 109).

The final requirement would be fissile material. The conventional view is again biased towards fully enriched Uranium 235 (U 235or HEU, derived from naturally occurring U238), and Plutonium 239 (Pu 239). Mark Taylor and other former Los Alamos scientists maintain that enriched uranium is not required and that reactor grade

Uranium will do (Mark, Taylor 1993, 1; O'Neil 1997,4; Taylor 1996, 4-7; Committee on International Security and Arms Control of the National Academy of Sciences 1994, 1-3; Center for Nuclear Disarmament-Cymru 1997, 1-4).

By way of background on nuclear weapons design and fissionable material, there are respectively two types of each. The first type, the "gun-barrel" type, as used against Hiroshima, utilizes Uranium (U) 235 for a fuel, which is designed to achieve super criticality by firing a U235 slug into a larger portion of U235. When the two pieces join, a quantity of neutrons are released, and a chain reaction occurs. The reaction becomes self-sustaining, and when the quantity of neutrons becomes greater than that required from self-sustainment, a nuclear detonation ensues (McPhee 1973, 109; Rhodes 1988, 701-2).

The implosion weapon as used against Nagasaki differs from the gun-barrel weapon in design and type of fuel used. The implosion type device relies on a sphere of Pu 239, surrounded by several layers of explosive. When the conventional explosive which is designed to implode in on the Pu 239 core is detonated, the ensuing shockwaves travel inwards and compress the core to criticality and beyond, causing a nuclear detonation.

Uranium 238 differs from plutonium 239 in many ways. Uranium occurs in nature in the ground and can be mined. Plutonuim 239 was the first ever manufactured element (McPhee 1973, 16, 35-6). Chemically, U238 and U239 are identical, and whatever the physical process used to separate the weapons grade U235 from the base of U239, the process has been described as "one of the hardest things human beings have ever tried to learn to do" (McPhee 1973, 17). Plutonium is the preferred explosive fuel

for implosion weapons, as it takes less of it (mass and space) to produce the equivalent explosion if U235 were used. Plutonium is highly radioactive, unstable, and highly poisonous. Plutonium is unsuitable for a gun-barrel type weapon due to its radioactivity. Stray neutrons from naturally decaying Pu 240 (which cannot be separated from Pu 239) make plutonium much more difficult to work with than Uranium.

Both types of fuel are usable in an implosion weapon, but plutonium is unusable as a fuel for a gun-type weapon because "neutrons, which travel at speeds in excess of 15,000,000 miles an hour, would jump from one mass [of plutonium] to another before the two pieces before a proper assembly could be achieved. The result would be a fizzle yield" (McPhee 1973, 192). The "fizzle yield" or preassembly will be further discussed in chapter 5. The central argument for a potential bomb maker is What is the fuel source that I have to work with? Tests in the late 1940s confirmed that a much better yield could be achieved using U235 in an implosion weapon, as the implosion weapon is much more efficient than the previous gun-type weapon (Mark 1983, 4). Plutonium is also more difficult to work with. Plutonium gives off heat as it undergoes nuclear decay, which must be taken into consideration in the design, however crude it might be (Committee on International Security and Arms Control 1994, 2).

The final critical difference between gun-barrel type weapons and implosion type weapons is their likelihood of successful detonation producing a nuclear yield. The gun-barrel type has physically fewer moving parts (a uranium slug fired by a single charge of propellant), and less of a possibility of preassembly due to U235 being less reactive than Pu 239 (Mark 1990, 4). The implosion type weapon relies on a series of critically timed explosions, which must occur as close to the literal meaning of "simultaneously" as

possible, to squeeze a core of Pu 239 to supercriticality, resulting in an explosion. The components also must be brought to criticality as fast as possible, in order to avoid preassembly, or a "fizzle yield," a probability which is much higher in Pu 239 weapons than in those using U 235 (Mark, Taylor 1993, 5). Nuclear designer and Manhattan project member Luis Alvarez stated, "With modern weapons-grade unranium, the background neutron rate is so low (the cause for fizzle yield) that terrorists, if they had such material, would have a good chance of setting off a high-yield explosion simply by dropping one-half of the material on the other half" (Mark 1990, 5).

As previously cited, the requirements to produce a nuclear weapon are the knowledgeable people to run the program and the fissile material to make it work. The availability of fissile material, namely U 235 (HEU) or Pu 238, both known as "weapons-grade" materials, is a source of great concern for many countires, the United States included as witnessed by Presidential Decision Directives 39 and 62 and the Defense Counter-Proliferation Initiative. Discounting a terrorist attack on an already existing nuclear weapon in order to steal it and use it (Mark 1983, 5), the other possibilities include a raid on a nuclear reprocessing plant, where plutonium is separated from spent fuel rods, or purchase. The central focus of the International Atomic Energy Agency Nuclear Safeguard program is the protection, processing, storage, and shipment of HEU and Pu 239 (McPhee 1973, 73-5). The scope of that program and its work are beyond the scope of this thesis. There are five likely sources of nuclear material to a terrorist organization. They are:

> First and foremost the difficulties arising from the former Soviet Union. The trafficking in nuclear materials acquired from the former Soviet Union and the concomitant lack of adequate controls and accounting of fissile materials. Second

> is the growing stockpile of plutonium resulting from both the dismantlement of nuclear weapons and the production of plutonium from reprocessed civilian reactor fuel. Third, the inadequacies of safeguards over nuclear technologies and materials have created unacceptable proliferation risks. Finally, strategies will have to be developed to address both those states not members of the NPT (Non-Proliferation treaty) with unsafeguarded nuclear facilities and those with clandestine nuclear weapons programs. (Roberts 1996, 2)

The fifth source of nuclear material is that from the reactor fuel itself. As previously stated, plutonium is a by-product of a power-generating nuclear reactor. The quantity and specific isotopes of Plutonium found in spent fuel depend on how long the fuel was in the reactor and how much power out the reactor was producing, which is referred to as "burn up" (Mark 1990, 2). The debate on whether fissile material can be taken from a reactors core and used successfully in weapons application has been debated for many years, first mentioned by Ted Taylor in John McPhee's "Curve of Binding Energy in 1974," and addressed by J. Carson Mark as late as 1993. As self-defense differs from anticipatory self-defense in the legal world, so weapons grade versus reactor grade, or "weapons usuable" plutonium is argued in the world of counterproliferation.

The question may have already been answered. "'The 1962 Test' is an example. It was a nuclear explosive device that used 'reactor grade' plutonium instead of 'weapons grade' plutonium. It was Top Secret, but 14 years after the explosion, its story was selectively marketed to support a political policy" (Rossin 2001, 2). Rossin cites J. Carson Mark's 1990 "Reactor-Grade Plutonium's Explosive Properties" as the authority that confirmed that a weapon was exploded using reactor grade plutonium as a fuel (Rossin 2001, 2-3). Mark does comment that:

> It has been suggested that the U.S. appears to have made only one experiment using reactor-grade plutonium and has not chosen to adopt it for regular weapons production indicates that the material is of little worth. That is not the correct

> interpretation. There is, of course, no question but that weapons-grade material is preferable from a design standpoint; and if, as for the U.S., one has the option and is paying for the plutonium anyway, one chooses the most advantageous. So would the terrorist if he had the choice. But if he can't get weapons-grade material he would take whatever he can get, should any be open to him. (Mark 1990,5)

It is interesting to note that while Ted Taylor worked at Los Alamos during that time, there is no discernable mention of the test in any of his works or in the McPhee work "The Curve Of Binding Energy."

The 1990 Mark work identifies three main pointes regarding using reactor fuel in a nuclear device: criticality problems of nonenriched plutonium, the effects of predetonation on yield, and finally problems a terrorist would encounter (Mark 1990, 1). Mark gives the bare critical mass requirements for each type of fuel in several contaminations summarized below. Bare critical sphere refers to the amount of fissile material alone, without shielding, a reflector, or a tamper. Quantities would be much less with the aforementioned devices utilized, as they would be in a weapons application.

Table 3. Bare Sphere Critical Masses of Uranium 235, Plutonium, and Other Fissionable Materials

Material	Bare Critical Sphere
Uranium 235	50 kg
Plutonium 239 metal Weapon grade (94% Pu 239) Reactor grade (65% Pu 239)	10 kg 17 kg 20 kg
Uranium 233 Neptunium 237 Americium 241	15 kg 60 kg 100 kg

Source: O'Neil 1997, 4.

With regard to the question of preassembly or "fizzle yield," as the fuel source becomes more contaminated (a lower percentage of U 235 or Pu 239), the probability of predetonation increases. Predetonation is coupled directly with yield. In all of the above fuels, regardless of the type, a fizzle yield would have a yield of at least one kiloton (Mark 1990, 4). To paraphrase, the worst that could be expected is a one-kiloton yield, with the probabilities for greater yield higher for cleaner fuel. The better the fuel, the better the theoretical yield, and the higher probability that the theoretical yield could be achieved. A fizzle yield of a one-kiloton explosive device would have about one-third the effect that the bomb dropped on Hiroshima did (Committee on International Security and Arms Control 1997, 2).

The maximum yield that could be expected from a weapon above depends on the skill of the designer, but would probably be in the ten kiloton range or higher (Mark 1990, 4).

The principal difficulties that a terrorist would encounter would be competence in the technical areas of shock hydrodynamics, critical assemblies, chemistry, metallurgy, precision machining, electrical circuits, explosives, and health physics (Mark 1990, 5). The terrorist would also be required to perform all of these tasks in secret, if working clandestinely against the wishes of a host country.

The precise quantity of nuclear material, both specifically enriched weapons grade HEU and Pu 239, and that found in the 400 nuclear reactors in thirty-two nations worldwide is unknown. It has been estimated that 200 kilograms of plutonium are produced for every 1,000 megawatts of power sent forward. With a nuclear generating capacity of 340,000 megawatts, the total amount of plutonium produced each year is

nearly 70,000 kilograms (Taylor 1996, 2). That is not specifically enriched weapons grade HEU or Pu 239, but does include Pu 239, Pu 240, Pu 241, Pu 242, Uranium 233, Neptunium-237, and Americium-241 (O'Neil 1997, 4).

The quantity a terrorist would need to produce an explosion again depends on the skill of the designer, the design used, and the material acquired. The classic "trigger amount," the amount of material determined by the United States Atomic Energy Commission to be "strategically significant," is five kilograms (McPhee 1973, 16). Due to the physical characteristics of the gun-barrel type bomb, something on the order of two critical masses would be required (O'Neil 1997, 5). Current United States warheads are said to contain "about three kilograms," and that is much more than a skilled designer would require to create a nuclear explosion (Taylor 1996, 2). Two factors obscuring the amount actually needed are the sophistication of the design and what surrounds the nuclear material. "The mass of fissile material required to create a detonation varies inversely with the square of the density of the surrounding material" (Mark and Taylor 1993, 2). The more dense the surrounding material (reflector or tamper), the less fissile material is required. Using beryllium, an especially good reflector, the amount could be as low as one-third the bare critical mass from table 3. As beryllium is considered to be too difficult to work with without experience and specially designed machinery, a value of one-half the bare critical mass, or twenty-five kilograms of U 235, and between five and ten kilograms of Pu 239 depending on purity would be sufficient (Mark, Taylor 1991, 5).

The International Atomic Energy Agency established in 1956 with a charter "to foster the exchange of scientific and technical information on peaceful uses of atomic

energy" and to establish a "safeguards" system to ensure that fissile materials "are not used in such a way as to further any military purpose" (Roberts 1995, 6). Safeguards deal more with security of the material produced than with reactor safety. But the he verification of safeguards internationally is a difficult problem. It was estimated in 1994 that "up to 3 percent of plutonium at reprocessing facilities is unaccounted for and subject to illicit diversion" (Roberts 1995, 6). With 70,000 kilograms produced each year (Taylor 1996, 2), 3 percent missing equates to 2,100 kilograms.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Legal Implications

The legal implications of a United States strike against a weapon of mass destruction possessed by a terrorist group in the sovereign territory of another country are different from almost any other country in the world. Principally, as a permanent member of the United Nations Security Council, the United States, along with China, France, Russia, and Great Britain, it can veto any resolution, and it is unlikely to sanction itself (California Polytechnic University 2002, 2). This unique ability to nullify any votes against its own interests indicates that whatever the actions of these countries, a United Nations sanction or resolution against it will not be forthcoming. In the construct of the United Nations, the argument of anticipatory self-defense in regard to United States military actions would appear to be moot. While anticipatory self-defense will undoubtedly remain a topic of great debate between other nations, its interpretation is not a cause of concern for the permanent members of the United Nations Security Council.

The justifications for the use of force in anticipatory self-defense are the requirements of necessity, proportionality, and immanency. While recognized under international law as previously cited, anticipatory self-defense remains a topic of debate in the international community. The necessity to use force would require that the other implements of national power, diplomatic, economic, and information had been attempted, and force was the last option. Proportionality addresses attacking that which threatens, not attacking en masse or a country in general. Immanency addresses an

urgent need, not a future fear of attack. It would require a significant intelligence effort to determine immanency. After such an attack by the United States would certainly argue that anticipatory self-defense was authorized by Article 51 of the United Nations Charter in the "counter-restrictionist" school of thought (*Military Law Review* 1995, 8).

Foreign Policy and Preemption-benefits and risks.

The crucial question regarding preemption, especially when dealing with nuclear weapons, is risk versus reward. In "Radical Responses to Radical Regimes: Evaluating Preemptive Counter-Proliferation" by Barry Schnieder, written for the Institute for National Strategic Studies in 1995, the author lays out eleven criteria for decision makers in determining the risk versus reward payoff. They are:

1. Is the enemy undeterrable, violent, and a risk taker?
2. Is the enemy on the WMD threshold?
3. Are United States vital interests directly threatened?
4. Are key enemy targets precisely located and targeted?
5. Is surprise achievable?
6. Does the United States have a first strike capability?
7. Is the United States homeland safe from enemy WMD?
8. Would the United States be safe from WMD retaliation by third parties?
9. Has the United States exhausted all other non-military options first?
10. Has the United States set clear objectives and is it using appropriate means?
11. Is the United States Committed to win? (Schnieder 1995, 23-6)

While several of the criteria are hard to quantify, a few clearly address the ability of United States intelligence organizations, namely the questions of weapons of mass destruction threshold, the location and targeting of weapons of mass destruction, and the ability to achieve surprise. Additionally, the question of the safety of the United States homeland further asks the question, Can terrorists build nuclear weapons? A question that will be answered later on in this chapter.

While the rewards could be quantified as a safe and secure America and a more peaceful international environment, the risks are not so evident and vary with regard to the type of preemption conducted. In an air strike or a cruise missile attack, the partial or total destruction of a nuclear power plant or production facility poses unique concerns. Depending on location, nuclear contamination of the area surrounding the facility could easily occur. If all of the nuclear devices were not destroyed on the first attempt, a potential enemy would most assuredly respond with any remaining nuclear weapons. A final risk is that if he did not possess a nuclear device, and his reactor was destroyed, it would be much more economical to build a weapon that to repair the reactor. In this scenario, preemption would appear to cause more problems than it would solve.

An excellent historical example of this is the United States blockade of Cuba during the Cuban Missile Crisis. Without firing a shot, retaliation was averted, no irradiation of the countryside occurred, and the nuclear peace was maintained. With regard to the historical examples of preemption as listed in Table 1, only two of nine attacks were successful on the first try, regardless of the type of preemption. While it is not believed that any of the countries possessed a nuclear capability at the time of the respective attacks, the Cuban Missile Crisis blockade is arguably the most effective and least risky form of preemption.

Further foreign policy implications would depend on the United State's present relationship with the country in which the attack occurred, what its desired relationship would be at end state and the nature and capabilities of the country itself. The first question would be, Can or would the country preempt the weapon themselves without United States assistance? The second question would be, Does the country have an

economic or natural resource base that the United States would be denied after preemption? Finally, what would world opinion be if the United States attacked? To answer the first question, it is not probable that the United States would attack the IRA in Northern Ireland because they had obtained a weapons of mass destruction. Great Britain would undoubtedly be judged to have the capability to deal with the threat without United States assistance, and if the IRA had a bomb, the United States would not be the first on the target list for the IRA. Lesser-developed countries, such as Yemen or Somalia, would probably not be judged to be able to deal with the threat alone. To answer the second question, an attack on an economic partner, such as Japan, Canada, Mexico, or Korea, would certainly not be in the best economic interest of the United States. An attack on any OPEC country would have a significant impact on the United States economy.

World opinion would also weight heavily in any decision to conduct preemption against a weapons of mass destruction. In the current construct of world politics, an attack on an Islamic country presents a unique problem for policy makers. Regardless of the intelligence, proving that the weapon was destined to be used against the United States would be difficult at best.

United States Nuclear Policy in the Post-Cold War World

While there has been no formal announcement that "deterrence is dead" as a United States policy, it has essentially be replaced in part by the Nuclear Posture Review, specifically regarding terrorism by Presidential Decision Directives 39 and 62. The Nuclear Posture Review, as discussed in chapter 4, differs considerably from the old concept of the nuclear triad, that of bombers, ICBMs, and submarine-launched ballistic missiles. It addresses defensive systems, both active and passive, nonnuclear offensive

strike systems, defense infrastructure, and finally information operations (Committee on International Security and Arms Control 1997, 1). United States nuclear policy has evolved from a nuclear only response to a nuclear threat to several nonnuclear options as mentioned above.

Presidential Decision Directives 39 and 62 specifically address weapons of mass destruction and terrorism both at home and abroad, declaring in Presidential Decision Directive 39, "The acquisition of weapons of mass destruction by a terrorist group, through theft or manufacture, is unacceptable. There is no higher priority than preventing the acquisition of this capability or removing this capability from terrorist groups potentially opposed to the U.S." (U.S. President 1995, 9). This indicates that Presidential Decision Directives 39 and 62 and the Nuclear Posture Review are mutually supporting and complimentary to the foreign policy of the United States.

The case for a terrorist designed, produced, and delivered nuclear weapon. The debate on the ability of terrorist organizations or third world countries to design, produce, obtain, and deliver nuclear weapons is as controversial in the physics community as the debate surrounding anticipatory self-defense in the legal community. The "obtain" portion of the argument will be addressed later in a discussion of the Counter Proliferation Initiative. Due to safeguards installed in United States nuclear weapons, and their very design, it is highly unlikely that a terrorist group could steal a warhead or warheads from the United States military, and use them in that form. Additionally, the relatively small amount of fissile material present in modern United States nuclear warheads would require an extremely experienced and sophisticated designer to remanufacture the material for re-use. The "delivery" argument is directly linked to what

type of weapon would be produced, which is further dependant on the type of fissile material available.

While the argument concerning the production of fission weapons in the multi-kiloton range has gone on for years, it is almost universally accepted that a fusion weapon, a hydrogen bomb, is beyond the ability of a terrorist or third world nation. When asked if he worried about people designing hydrogen bombs in their basements, Ted Taylor said,

> I can't tell you anything at all about that except that my opinion is that a home-made H-bomb is essentially an impossibility. One can't even hint at the principles involved, beyond saying that it requires heating some material up to a terribly high temperature, which is why it is called a thermonuclear bomb. There are by now (1973) several thousand people who know how this is done, so the secret of the H-bomb will out somewhere along the line, but, even when it does, the fact remains: to make an H-bomb is not a basement operation. The project would take a large, well-organized group of people a great deal of time. The secret, incidentally, is not a matter of materials. It is a matter of design. (McPhee, 1973, 103-4)

The material McPhee refers to is deuterium, which can only be produced in a nuclear reactor, in an extremely expensive ($800,000 per kilogram in 1973) and complicated process.

Another debate in the nuclear weapons arena is the feasibility of using non-weapons-grade fissile material for a fuel, or those isotopes other than Uranium 235 (HEU) or Plutonium 238 (Pu 238). J. Carson Mark and Ted Taylor, both veterans of the Theoretical Division at the Los Alamos Nuclear Labs, as stated in chapter 4, say that it can be done. While there is still resistance to the idea, it has gradually come to be accepted that a bomb can be built by using the fuel from a nuclear reactor. Table 3 lists the bare critical sphere weights of various nuclear fuels, ranging from 10 kilograms of Pu

239, through 50 kilograms of HEU, to 100 kilograms of Americium 241. Bare critical sphere, or "bare crit" refers to the amount of material required to produce a critical mass with no reflection. While it would be possible to build an HEU gun-type weapon with no reflector, it would not be possible to build an implosion type Pu 239 weapon without a reflector, so the value for Pu 239 should be closer to about 10 kilograms. A reflector serves two purposes: first, to physically protect the fissile material from damage and second, to reflect neutrons during the initial stages of supercriticality, to improve efficiency and reduce the amount of fissile material required. The better the reflector, the less material required, and the more likely a successful detonation.

Ted Taylor spent the bulk of his professional life producing nuclear weapons that were increasingly smaller (with regard to physical size and amount of fissile material required) in size and larger in yield. Taylor designed the Super-Oralloy bomb, which was reported to have been the only fission weapon ever produced to achieve a greater than one megaton yield (McPhee 1973, 91). As the weight of fissile material in a weapon is restricted by the critical mass, more material is not what is needed, and a better reflector is the only way to achieve those results.

In a 1962 atomic weapons test, reactor fuel was used as the fissile material instead of HEU or weapons grade Pu 239. While it remains unclear if the test was to see if reactor fuel would work or if the test was to "determine the cross sections of the higher isotopes," it did occur (Rossin 2001, 3). It is undetermined if the bomb was a gun type or an implosion type, but with plutonium as a fuel, it was undoubtedly an implosion type weapon. The yield was never released. That bomb was designed by the Theoretical Division at Los Alamos, with the experience of many scientists that designed the first

nuclear weapons, and had designed other nuclear weapons, standing on the shoulders of the Manhattan Project. It was not designed or assembled by a terrorist organization or by a country trying to assemble its first bomb.

While working at the Atomic Energy Commission, Ted Taylor asked to build a bomb from publicly available information, namely the "Los Alamos Primer," reactor manuals, and college textbooks, to finally settle the argument. To build a "conservative, purposely sloppy bomb." The Atomic Energy Commission declined, and the test never occurred (McPhee 1973, 24).

The type of nuclear device that a terrorist would be able to produce would depend on the type of fissile material he would be able to obtain and how he intended to deliver the weapon to its intended target. If the weapon was to be delivered by air, either by aircraft or missile, then the weapon would most likely be an implosion type fueled with Pu 239, requiring a significantly more sophisticated design to physically fit into the delivery system. If the delivery system did not restrict the size or weight, then a gun-barrel-type HEU weapon would be preferable, due to its inherent simplicity. With regard to the likelihood of explosion, the much simpler gun-barrel type would be preferred over an implosion type weapon. A gun-barrel type weapon is also less likely to preassemble or "fizzle yield." Table 4 indicates the respective strengths and weaknesses of each type of system.

Table 4. Comparison of Weapons Types

Property	Gun-barrel	Implosion
Ease of manufacture	Easier	Harder
Material	HEU	HEU, Pu 239 (all isotopes)
Potential yield	Lower than 10 KT	Higher than 10 KT

Likelihood of detonation	Higher	Lower
Fizzle Yield	Greater than 1 KT	Greater than 1 KT

It is evident that if a terrorist wanted to demonstrate the ability to produce and detonate a nuclear weapon, it would be wiser to choose a gun-barrel-type weapon. The single drawback of this type of weapon is the requirement to use HEU or reactor fuel that has not been significantly contaminated with Plutonium isotopes. While this weapon would possibly be air deliverable, it would in any case be larger than an implosion type weapon.

If a terrorist was determined to deliver the weapon by air, then an implosion type weapon would be preferred for size and weight considerations. A well-designed implosion type weapon would also offer a potentially higher theoretical yield due to the use of Pu 239 and the inherent advantages of implosion systems.

Regardless of the type of weapon design chosen, a yield of at least one kiloton would be the minimum encountered assuming the rest of the detonation systems had functioned properly. While a fizzle yield would do less immediate physical damage due to blast and shock, it would still produce significant radiation effects. The fizzle yield presents another problem, that of nuclear contamination. Although not previously addressed, a radiation dispersal device, designed to spread radioactive material rather than fission it, is not technically a weapon of mass destruction, but a weapon of mass effect. As a fizzle yield would certainly heavily contaminate the surrounding area with radioactive material as the weapon detonated, the two devices will be treated the same.

In 1987 a 20-gram sample of cesium-137 chloride was found at a cancer clinic in Rio de Janiero, Brazil, and broken apart for scrap. Eventually 4 people died, 249 were hospitalized, and some 6,000 tons of furniture, clothing, and contaminated items were

sealed in steel drums and sent to an abandoned quarry (O'Neil 1997, 7). That was just twenty grams. The quantity of plutonium to achieve the same effect would be much less.

> Plutonium is worse it its toxicity than as a bomb. Plutonium is worth, at most, ten dollars a gram. If the Black September organization had a hundred grams of micrograms--a million micrograms--and if it were properly distributed, it would bring one times ten to the sixth fatalities. A microgram inhaled can cause bone cancer. . . . Plutonium is one of the most toxic substances ever known in the world. Cobra venom is nowhere near as toxic as plutonium suspended in an aerosol. You could hold an ingot of plutonium next to your heart or brain, and fear no consequences. But you can't breathe it. A thousandth of a gram of plutonium taken into the lungs as invisible specks of dust will kill anyone--a death from massive fibrosis of the lungs within a matter of hours, or at most a few days. Even a millionth of a gram is likely, eventually, to cause lung or bone cancer. Plutonium that enters the bloodstream follows the path of calcium. Settling in bones, it gives off short range alpha particles, a form of radioactivity, and these effectively destroy the ability of bone marrow to produce white blood cells. (McPhee 1973, 69, 44)

As a terrorist organization would require kilograms, not grams, of plutonium to fabricate a bomb, a poorly designed or malfunctioning bomb producing a fizzle yield would not be a failure at all. For an even greater effect, aerosolized plutonium dispersed in a populated area would, in regard to casualties, have a much greater effect.

In the construct of game theory and the "Prisoners Dilemma," what would be the penalty and the payoff for a terrorist organization to use a nuclear device against the United States? The penalty is evident: nuclear retaliation. The payoff of not using a nuclear weapon would be the maintenance of the status quo, which is not generally what a terrorist organization desires. It would be unlikely that a terrorist organization would possess an assured second strike capability, as it would be unlikely that a terrorist could destroy all of the United States' second strike platforms. What a terrorist would gain would be the notoriety of an attack on America. In an air-delivered weapon, be it aircraft or ballistic missile, the point of origin would be readily discernable. Even in the case of a

ship delivered weapon in a cargo container, the origin would eventually be discovered. The intelligence process of working backwards from a detonation in the United States is much harder to grasp. It would be possible to determine to some extent what the explosive material was, and what components went into its manufacture, but determining the origin would be extremely difficult. This would make a retaliatory strike much more difficult to justify based just on intelligence. The Prisoners Dilemma is still valid then, with the exception that the two "players" are not peers, and one has much more to gain by shooting that the other does by not.

The Defense Counter-Proliferation Initiative

In 1993, the Department of Defense announced the Counter-Proliferation Initiative to combat the spread of weapons of mass destruction, especially in the cases of North Korea and Iraq (Schnieder 1995, 1). Its purpose was to provide the commander tools in which to unilaterally disarm an opponent of the battlefield of his weapons of mass destruction. These tools include nonnuclear precision-guided munitions and added the counterproliferation (CP) mission to the list of missions conducted by Special Forces (Special Operations Forces Reference 1998, 1). The CPI nests with Presidential Decision Directives 39 and 62 and with the Nuclear Posture Review. These policies are mutually supporting. What the CPI does not address is the actual proliferation of nuclear materials (fissile) and the knowledge to apply them.

The Nuclear Non-Proliferation Treaty of 1968

The Nuclear Non Proliferation Treaty addresses this aspect, under the auspices of the International Atomic Energy Agency, contained in the Treaty of the Non-Proliferation

of Nuclear Weapons (1968). While the treaty, to which the United States is a signatory, forbids specifically the transfer of "special nuclear materials," understood to be weapons grade Pu 239 or HEU, and such technology to produce these materials, it does not address reactor grade fuel, or "weapons usable" materials. There are 187 signatories to the treaty, including the United States, United Kingdom, Russia, France, and China (IAEA NPT, 1968, 2). The IAEA has no enforcement arm other than the United Nations Sanctions as seen in the case of Iraq after Operations Desert Shield and Desert Storm. An apparent lack of a prevention mechanism for reactor grade is present, both in United States policy and in the international arena. The Counter-Proliferation Initiative gives commanders the ability to interdict after the fact, but does not prevent from the source the spread of unrefined nuclear materials, specifically "weapons usuable" uranium and plutonium. The difficulties in accounting for special nuclear materials in nuclear power plants and in processing centers are many, varied, complicated, and in contention. Each of the 187 signatories has essentially agreed to surrender a small bit of sovereignty to allow the IAEA to inspect its programs. The IAEA does not inspect military facilities, just reactors and facilities dedicated to civilian nuclear power. The particular processes to determine missing special nuclear material have been in contention since the inception of the treaty, but the allowable quantity of missing material is well above the trigger amounts for both Pu 239 and HEU (McPhee 1973, 42-44, 67). The reasons, then, that all nuclear material is not tracked, like weapons grade material, are two: first, that it is hard enough to track enriched weapons grade fuels, which constitute on an order of magnitude a smaller physical quantity to account for, and secondly, the denial by the nuclear community that non-enriched fuels (weapons usable) can be used for military purposes.

It is interesting to note that the Treaty on Non-Proliferation was signed six years after a nuclear test in which the United States used nonenriched fuel in a fission explosion device. Short of the abolition of nuclear power as an energy source, this problem will not go away, ever. The quantity of nuclear fuel used every year rises, the amount of plutonium produced every year increases and with those two, so does the probability of a nuclear device being produced by a terrorist organization.

Putting The Nuclear Genie Back in the Bottle

There does not appear to be an easy solution to the problem of proliferation on nuclear materials, be they "special" materials or weapons useable. It has been argued that it is impossible to "put the material back in a vault, and turn the vault back to 1942" or to "outlaw the atom" (McPhee 1973, 4, 67). In the calculus of nuclear power, a reactor is either a medium of production of special nuclear material or an excellent source of fuel for a nuclear device. Stricter safeguards for all materials are needed, not just those for special nuclear materials. This costs money, takes time, and must be monitored by a neutral third party (an international organization like the IAEA), and countries possessing nuclear power plants must be willing to be monitored. As noted earlier, Iraq was in full compliance with the IAEA safeguards program before the Israeli attack on the OSIRAQ nuclear facility, while Israel is not a signatory of the Non-Proliferation Treaty, and does not consent to IAEA monitoring. The degree of sovereignty that member countries would have to surrender in order to be monitored would perhaps be more than any country would be willing to sacrifice to appease the IAEA. As an example, is it doubtful that the United States would allow Chinese, French, and Russian inspectors in to the Department of Energy facilities in New Mexico, or the PANTEX plant in Texas, or at the

Naval Ordnance Detachment in McCallister, Oklahoma. It would appear then that alternative energy sources would be an option to reducing the requirement for nuclear power production, and therefore weapons production.

The Special Case of Iraq

While not a terrorist organization but a sovereign nation, significant literature and ordnance have been devoted to the Iraqi nuclear power and weapons of mass destruction programs. The object of United Nations Sanctions, air attacks by Israel, Iran, and the United States with coalition forces during the Gulf War and the continuing prosecution with Tomahawk Land Attack Missiles against Iraqi nuclear facilities, such as the Zaafaraniyah nuclear complex, indicate Iraq as the premier example and target of counter-proliferation by preemption. The question of why Iraq has not as of yet exploded a nuclear device is unclear. It could be that the quest for an intermediate range ballistic missile (SCUD) delivered warhead is beyond their capabilities to design or that their nuclear weapons program is not as advanced as was first thought. More plausibly, the Iraqi's may stand to gain more by not exploding a device than by exploding one. Proof that it could produce a viable nuclear device would undoubtedly bring a different kind of response from the United Nations and would change the entire United States-Iraq dynamic. It is hard to believe that after some twenty-five years of possessing a nuclear power plant, that the Iraqis do not have enough material to produce a crude, low-end gun-type nuclear weapon and demonstrate a true nuclear capability.

11 September 2001

Along with the Iraqi question discussed above, the attack on the World Trade Centers in New York City in September 2001, using conventional weapons in an unconventional way is an anomaly. If the terrorist group responsible for the attack had nuclear weapons, why would they wait to use them? The sophistication displayed in the simultaneous attacks in New York City and Washington, D.C., was beyond what any intelligence agency had predicted. Hopefully the intelligence estimates for Iraq and terrorist organizations will be more accurate in the future.

Recommendations for Further Studies

Although this thesis was not specifically about nuclear weapons or safeguards in the nuclear industry, a further study at a classified level would be beneficial to explore the possibility of a terrorist produced nuclear device.

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Critical Technology (3)	/	Section 4	/	31
Administrative Operational Use (7)	/	Chapter 2	/	13-32

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Limitation Justification Statement	/	Chapter/Section	/	Page(s)
	/		/	
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